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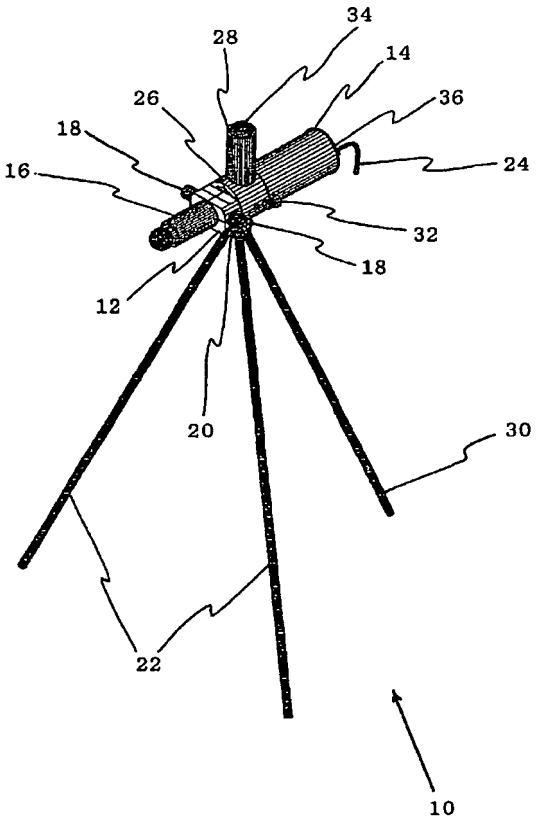
(54) Title: BALL PROPELLING MACHINE



(57) Abstract: The invention relates to an expanding gas ball propelling machine (10) for propelling a ball (34) towards a target. The machine can be used in a large number of ball sports, including baseball, softball, tennis, cricket and volleyball. The ball machine includes a ball feed tube (28) for loading a ball into a feed chamber (46), a feed piston (44) to advance a ball in the feed chamber chamber, which may optionally incorporate a ball spinning component (12) for applying spin to a ball prior to firing, and a reservoir of compressed gas (14). In use, compressed gas firstly causes the feed piston to advance a loaded ball into the firing chamber and subsequently upon firing propels the ball from the machine.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

BALL PROPELLING MACHINE

FIELD OF THE INVENTION

The invention relates to a ball propelling machine for simulating balls propelled in sports such as baseball, softball, tennis, cricket, volleyball and the like.

BACKGROUND OF THE INVENTION

For many years ball propelling machines have been used as a training aid in a variety of sports. There are a number of different types of ball machine presently available. However, three forms of ball machine dominate the market. One type uses a pair of counter-rotating wheels to propel the ball, another uses a mechanical arm to throw the ball, and a third uses expanding gas, such as compressed air, to propel the ball from the machine.

US Patent No. 6, 202,636 is an example of the third type, and describes a pitching machine which relies on expanding gas to propel a ball down a barrel towards an intended target. Some variability in the amount of spin imparted to the ball can be achieved by means of an adjustable friction surface which forms a portion of the barrel. However, there exists a need in the art for a ball propelling machine that offers advantages in terms of ease of use and/or flexibility in terms of imparting spin and/or velocity to a propelled ball.

SUMMARY OF THE INVENTION

The present invention provides a ball propelling machine according to the following claims. Preferred features of the invention will be apparent from the dependant claims and from the following description of the preferred embodiment.

It will be appreciated that the invention may be employed to simulate balls propelled in a wide variety of sports. In particular, it will be appreciated that the invention may be employed in baseball, softball, tennis, cricket, volleyball and the like.

While compressed air is preferred for propelling the ball, it would be readily appreciated by the skilled addressee that other expanding gases may be used. For example, the ball machine could be used in conjunction with a combustible gas and ignition source.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in a non-limiting manner with respect to a preferred embodiment in which:-

FIG 1 is a perspective view of the preferred embodiment of a ball propelling machine according to the present invention;

FIG 2 is a cut-away perspective view of the ball spinning component of the ball propelling machine;

FIG 3 is a cut-away perspective view of the loading and firing mechanism of the ball propelling machine;

FIGs 4(a) to 4(d) are sequential cross-sectional views of the ball propelling machine, demonstrating advancing and firing a loaded ball;

FIG 5 is a cut-away perspective view of a section of the advancing and firing mechanism of the ball propelling machine;

FIG 6 is a cut-away perspective view of a section of the feed piston and associated components of the ball propelling machine;

FIG 7 is a schematic view of an alternate ball spinning component for use in the ball propelling machine;

FIG 8 is a perspective view of a pair of ball supports of the ball spinning component of the ball propelling machine; and

FIG 9 is a cross-sectional view of the ball propelling machine showing the ball spinning component rotated 90 degrees in relation to the ball advancing and firing mechanism.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig 1 shows the ball propelling machine 10 which is the preferred embodiment of the present invention. The ball propelling machine includes a ball spinning component 12, motors 18, ball loader 26, air reservoir 14, ball feed tube 28, barrel 16, tripod stand 30 with legs 22, firing valve 32, tilting mechanism 20, ball 34, air inlet valve 36 and air inlet hose 24.

The main body components of the device, which include the air reservoir 14, ball loader 26, and ball spinning device 12 may be constructed from a variety of suitable materials which include various metals, metal alloys or plastics. Preferably, these components are constructed from aluminium. The tripod

stand 30 and tilting mechanism 20 which support the ball propelling device is conventional in design and construction. Varying the height of the tripod stand, for example by the use of telescopic legs, varies the height of the machine from the playing surface and consequently the angle of descent of a ball propelled towards a target. Varying the height of the device allows for the replication of balls propelled from players of different height, for example the tennis serve of tennis players of different height and/or reach can be replicated.

The ball feed tube 28 can be of any practical length and may be used to hold one or more balls prior to a ball entering the ball loader. The ball feed tube may be used in conjunction with a signalling device, so that the player has appropriate warning that a ball is about to be propelled. For example, a ball entering the ball feed tube may visually signal to the ball receiver that a ball is about to be propelled from the machine.

Control of inlet valve 36, firing valve 32, motors 18 and balls entering feed tube 28 may be via an appropriate programmable control module. Ideally, the control module can be used in conjunction with a portable computer and/or remote control unit. The air inlet hose 24 is preferably constructed of a resilient material such as rubber or plastic and is connected to a source of compressed gas, such as a cylinder of compressed air or powered compressor.

In operation, a ball 34 is positioned in feed tube 28 and comes to rest in a feed chamber in ball loader/advancer 26. Compressed air is supplied to, and stored in, air reservoir 14. As discussed below, the supply of compressed air to the air

reservoir forces the ball from the feed chamber into the ball spinning component 12, whereupon the desired axial spin can be imparted to the ball prior to firing. Where no spin is required, a simple firing chamber can be substituted for ball spinning component 12. Opening firing valve 32 allows the air stored in the air reservoir 14 to escape through barrel 16, thereby forcing the ball out through the barrel.

Fig 2 shows a cut-away perspective view of the ball spinning component 12 with only half of the housing illustrated. According to this preferred embodiment, the ball spinning component 12 includes two electric motors 18, associated ball supports 38 and bearing 40.

As stated above, the ball spinning device 12 can be made from metal, metal alloy or plastic, however aluminium is preferred. The ball supports 38 may be constructed of similar materials. Alternatively, it may be desirable to use a combination of materials in the manufacture of the ball support. For example, the face of the support which contacts the ball may be rubber or plastic and the stem aluminium.

Bearing 40 allows the ball spinning component to be attached to the ball loader 26, whilst allowing the ball spinning component to be rotated 360 degrees around the loading means. It will be appreciated by one of skill in the art, that the ball spinning component 26 of the present invention can be used in combination with other suitable ball loading mechanisms.

In use, ball supports 38 can be used to apply spin to a loaded ball. According to the preferred embodiment, the ball supports have a substantially concave surface which contacts the ball and enhances frictional drive between the supports and the ball. Motors 18 provide rotary motion to the ball supports 38, which in turn hold and rotate the ball about an axis. In an embodiment not shown, a single motor and ball support can be employed to rotate the ball. Alternatively, in a further embodiment not shown, a single motor and ball support opposing a ball support which is allowed to freewheel can be employed.

The rotation of the motors can be clockwise or anticlockwise depending upon the direction of axial spin required on the ball when fired. By varying the speed of rotation of the motors, it is possible to vary the amount of spin imparted on the ball when fired. Further, as discussed above, the spinning component 12 can be rotated relative to the ball loader 26, so that balls with, for example, topspin or sidespin can be propelled toward the target.

The distance between the two ball supports 38 may be slightly less than the diameter of the ball and hence in one arrangement the ball must be forced between the supports 38. In an alternative embodiment, the ball supports are able to retract so that the ball and/or the ball supports do not need to deform when the ball is positioned in the ball spinner. For example, the ball support and motor assembly may be resiliently biased towards the centre of the device by the use of springs or similar device.

Fig 3 depicts a cut-away perspective view of the ball loader 26 and air reservoir 14 according to the preferred embodiment. Ball loading device 26 includes feed chamber 46 which receives a ball that has passed through ball feed tube 28. Feed piston 44 functions to press or advance a ball from feed chamber 46 between, or into close proximity with, ball supports 38 in the ball spinning component 12.

Feed piston 44 is preferably constructed of aluminium and fits snugly into feed chamber 46, while being able to slide backwards and forwards in feed chamber 46. Piston 44 is biased towards the rear of air reservoir 14 by air reservoir spring 42. Other means of biasing the piston towards the rear of the reservoir will be apparent to the skilled addressee.

When no air pressure is inside air reservoir 14, piston 44 is retracted by spring 42 to allow a ball to be received in feed chamber 46 from ball feed tube 28. As compressed air is fed into air reservoir 14, the feed piston 44 is pushed forward to load a ball into a ball spinner or simple firing chamber, and to close the lower end of ball feed tube 28. In the preferred embodiment, the ball is fed into the ball spinner 12, to a position just short of the axis of rotation shared by ball supports 38. In use, and as will be discussed further below, once the supports begin to rotate, the ball is centred between the concave or cup-like faces of the ball supports. This arrangement allows piston 44 to stop short of coming into contact with ball supports 38. In an alternate embodiment not depicted, where spin is not required the ball is simply advanced into a firing chamber or receptacle.

Figs 4(a)-(d) show in detail the stages of advancing a loaded ball into the ball spinning component and firing the ball from the ball machine. Fig 4(a) depicts ball advancing device 26, firing valve 32, feed piston 44, valve body 58, receiver valve 54, pressure balancing port 64, port 48, connecting port 50, balancing pressure reservoir 52, spring 56, ball spinner 12, ball feed tube 28 and barrel 16.

In Fig 4(a) inlet valve 36 is open and compressed gas is free to enter air reservoir 14. The piston 44 is retracted toward the rear of air reservoir 14 to allow a ball to be loaded into the feed chamber of the ball advancing device 26. In Fig 4(b) compressed gas entering air reservoir 14 via valve 36 forces feed piston 44 to advance a loaded ball 34 into ball spinning component 12, wherein the desired axial spin can be imparted to the advanced ball. The gas pressure in the reservoir 14 also enters the balancing pressure reservoir 52 via pressure balancing port 64 and forces receiver valve 54 forward to form a seal with the internal rear of feed piston 44. In Fig 4(c) the firing valve 32 is opened and the gas in balancing pressure reservoir 52 escapes via connecting port 50. Thus, the gas pressure is reduced in the balancing pressure reservoir 52 below that in the air reservoir 14. Firing valve 32 is able to release gas at a greater rate than gas can enter balancing pressure reservoir 52 via pressure balancing port 64. Therefore, as the gas pressure in the air reservoir 14 is greater than that in the balancing reservoir 52, receiver valve 54 is forced back against spring 56 by compressed gas from the reservoir acting on the chamfered edge of the receiver valve 54. When receiver valve 54 is forced back, gas is able to escape

through the inside of feed piston 44 and through the inside of ball spinning component 12m thereby driving the ball ahead of the escaping gas. Fig 4(d) shows the ball loader mechanism after a ball has been fired from the machine. As the gas in air reservoir 14 has escaped, piston 44 retracts, allowing a further ball in the feed tube 28 to be loaded into feed chamber 46. Valve 36 then re-opens (as shown in Fig 4(a) and a new charge of gas is then allowed to enter reservoir 14.

Fig 5 is a cut-away perspective view showing the feed piston 44 in its fully forward position whereat the ball has been driven forward to a position so it is engaged by ball supports 38 and whereat the lower end of the ball feed tube 28 is closed or sealed. Fig 5 also depicts o-rings 60 and gallery 62.

As stated above, when compressed air is fed into air reservoir 14, the feed piston 44 is pushed forward to load a ball into spin imparting device 12. When feed piston 44 is fully forward the o-rings 60 located on the piston lie in grooves cut in the rear of advancing/loading means 26 and form a gallery 62 which connects the balancing pressure reservoir 52 to the firing valve 32 via connecting port 50. In an alternative embodiment, the balancing pressure reservoir 52 is directly connected to the firing valve 32 when the piston is in the forward position and there is therefore no need for the gallery 62. Whilst firing valve 32 is closed, spring 56 and air pressure through balancing port 64 act to hold receiver valve 54 closed against the internal rear of piston 44. O-rings 60 on receiver valve 54 prevent air leakage. When receiver valve 54 is in the open position and not in contact with the internal rear of the piston 44, port 48

connects the compressed air stored in the air receiver 14 with the internal chamber of the ball spinner via a hollow or channel through the inside of piston 44.

As stated above, opening the firing valve 32 decreases pressure in balancing pressure reservoir 52 and allows air in the air reservoir 14 to force open, or force back, receiver valve 54 via port 48. Once open, the compressed air is free to flow from the air reservoir 14 through port 48 and feed piston 44 and into the ball spinner or axial accelerator component 12. The escaping air then propels the ball from the spin imparting means through the barrel 16.

Fig 6 shows a more detailed view of an alternative cross section of the feed piston 44, receiver valve 54 and port 48. When in this position, compressed air is free to escape from the air reservoir 14, via port 48 and the inside of the feed piston 44 into the ball spinning device. As Fig 6 depicts the receiver valve 54 in its rear or open position, it is also possible to see seal 66. When receiver valve is in its forward or closed position, seal 66 rests against the internal rear shoulder of the feed piston 44 to prevent compressed air from escaping via port 48. Seal 66 is depicted in Fig 6 as a rubber ring, however, alternative sealing arrangements or suitable configurations of the receiver valve 54 and feed piston 44 would be apparent to one skilled in the art.

Advantageously, as the ball propelling machine of the preferred embodiment has essentially independent ball spinning and propulsion mechanisms, it is possible to apply spin of any orientation to a ball prior to firing. For example,

Fig 7 depicts an arrangement of the ball spinning device which allows a ball to spin about an axis parallel to the longitudinal axis of the barrel 16. Specifically, Fig 7 depicts a ball 34 surrounded by roller supports 68 whose axis of rotation can be arranged parallel or substantially parallel to that of the barrel. This arrangement will allow balls to be projected with a spin about an axis parallel or substantially parallel to their trajectory. Accordingly, balls that simulate a torpedo punt or quarterback pass can be simulated. Fig 7 represents one configuration for applying this type of spin to a propelled ball. However, it will be apparent to the skilled addressee that variations in the exact number of roller supports and/or the exact shape of the roller supports can be varied to suit different balls or applications without departing from the inventive concept of the present application. Roller supports according to this aspect of the invention can be constructed from either a rigid or flexible material, such as metal, metal alloy, plastic or rubber. Preferably, roller supports are constructed of plastics or rubber.

Fig 8 depicts ball supports 38 of the pitching machine of the preferred embodiment, with adjacent scalloped or arcuate grooves 70 meeting at peaks on the rim of their concave face. These grooves are preferably approximately as deep as the height of the stitching which protrudes from the surface of a ball, such as a baseball. As stated earlier the supports can be constructed from a combination of materials and in this regard, a non-stick surface may be employed on the cup-like faces of the supports to reduce the torque required from the motor, or motors, to position the ball.

To position a ball with surface stitching such as a baseball within the ball supports, one support can be rotated at a different speed or direction to the other for a fixed period of time. As slippage occurs between the ball and the scallops or grooves of the support, using this method the stitching of the ball can be positioned in a similar, or the same, position each time. Once the ball is in the desired position, the supports can be rotated in the same direction to spin the ball prior to firing. For example, baseballs are required to be thrown with the stitches/seam in a known position as this affects the movement of the ball through the air. If this is not taken into consideration, the distance a spinning ball moves off-line will differ each time a ball is released. Therefore, according to the present invention identical spin, in terms of both rate of revolutions and axis of rotation, can be applied to a loaded ball and hence it is possible to repeatedly simulate a desired type of pitch, throw, bowl or serve.

Fig 9 depicts the ball propelling machine with the ball spinning component 12 rotated at 90 degrees to the ball loading device 26. The relative movement of these two components can be best seen by comparing the position of the ball support 38 in Fig 9 with those in Fig 4. As can be seen in Fig 9, ball spinner 12 is connected to ball loader 26 by means of bearing 40 and is therefore free to rotate. Rotation allows the orientation of spin to change, for example, from topspin to sidespin. Rotation of the ball spinning component around the loading means can be automated, for example by a motorised pinion and ring gear. A control module may also be employed to vary the relative position of the two components.

The preferred embodiment of the present invention utilises *inter alia* a ball spinning component and ball advancing component. However, it will be appreciated by one of skill in the art, that the ball spinning component and ball loader of the present invention can be used independently. Accordingly, the ball spinning component of the present application can be adapted for use with other ball loading/propelling devices, where spin is required. Similarly, the ball loading component described herein may be adapted for use with other ball spinning mechanisms, or where no spin is required, a simple firing chamber.

It will be appreciated by one of skill in the art that the various functions of the ball propelling device of the present invention can be placed under the control of a programmable control module. Further, the control module may be used in conjunction with a portable computer and/or remote control unit. Parameters that may be varied using such a device include, for example, the rate, direction and angle of rotation, and velocity of a propelled ball. These devices and others would be readily apparent to the skilled person and are included within the scope of the present application.

Many sports require a signal so that the ball receiver knows when the ball is about to be propelled. For example, a ball visible to the ball receiver may be rolled down a track into the ball feed tube moments before an actual ball is propelled. According to this embodiment, as a ball falls into the feed tube a sensor fires the ball that is waiting in the spin imparting means. Alternatively, a clear plastic tube with a u-shaped bend in the top may be employed. In this way, a ball can be forced upwards to simulate a ball toss. When the ball

reaches the top of the clear tube, it falls into the feed tube and activates a sensor which fires the ball waiting in the spin imparting means. Alternative arrangements for signalling to the ball receiver that the ball is about to be propelled are known in the art and are included within the scope of the present invention.

It is to be understood that although the invention has been described with particular reference to specific embodiments thereof, the form of the invention shown and described in detail is to be taken as the preferred embodiment of same, and that various changes and modifications may be resorted to without departing from the spirit and scope of the invention as defined in the appended claims.

Claims:

1. A machine for propelling a ball towards a target to simulate a player in a ball sport comprising a ball loading component, wherein supply of compressed gas to the ball loading component advances a loaded ball into a firing chamber and upon firing of the machine the compressed gas propels the ball toward the target.

2. The machine of claim 1, wherein the firing chamber is located within a ball spinning component for applying spin to a ball located therein.

3. The ball machine of claim 1, wherein the ball loading component includes a feed piston to advance a loaded ball.

4. The ball machine of claim 3, wherein upon firing compressed gas is channelled through the feed piston to propel a ball from the machine.

5. The ball machine of claim 4, wherein the feed piston forms one part of a valve which is opened to fire a ball from the machine.

6. The ball machine of claim 5, wherein a second part of the valve includes a balancing pressure reservoir and the valve is opened by reducing the pressure in the balancing pressure reservoir.

7. The ball machine of claim 6, wherein upon firing the feed piston retracts so as to allow a further ball to be loaded into the ball loading component.

8. The ball machine of claim 2, wherein the ball spinning component includes at least one ball support.

9. The ball machine of claim 8, wherein the ball support has a substantially concave face which is capable of contacting a ball advanced into the ball spinning component.

10. The ball machine of claim 9, wherein the concave face has a plurality of adjacent scallops or grooves which meet at peaks on the rim of the face.

11. The ball machine of claim 8, wherein the ball support includes a cylindrical roller.

12. A machine for propelling a ball towards a target to simulate a player in a ball sport comprising:

a ball spinning component for imparting axial spin to a ball positioned therein;

a ball feed means for delivering a ball to a feed chamber;

a feed piston for advancing a loaded ball from the feed chamber into the ball spinning component;

a reservoir of compressed gas; and

wherein gas from the reservoir forces the feed piston to load the ball from the feed chamber into the ball spinning device and subsequently upon firing of the machine the expanding gas propels the ball from the machine toward the target.

13. The machine of claim 12, wherein the ball is a baseball and wherein the ball spinning component includes one or more ball supports having a substantially concave face and with a plurality of adjacent scallops or grooves which meet at peaks on the rim of the face.

14. A method of aligning a ball with surface stitching between two opposed rotating ball supports comprising rotating the ball supports at different angular velocities.

15. The method of claim 14, wherein the portion of the ball support which contacts the loaded ball has a substantially concave face with a plurality of adjacent scallops or grooves which meet at peaks on the rim of the face.

16. The method as claimed in claim 15, wherein the supports are rotated in different directions.

17. A machine for propelling a ball towards a target to simulate a player in a ball sport comprising at least one ball support capable of applying spin to a ball loaded into the machine, wherein the portion of the ball support which comes

into contact with the loaded ball has a substantially concave face with a plurality of adjacent scallops or grooves which meet at peaks on the rim of the face.

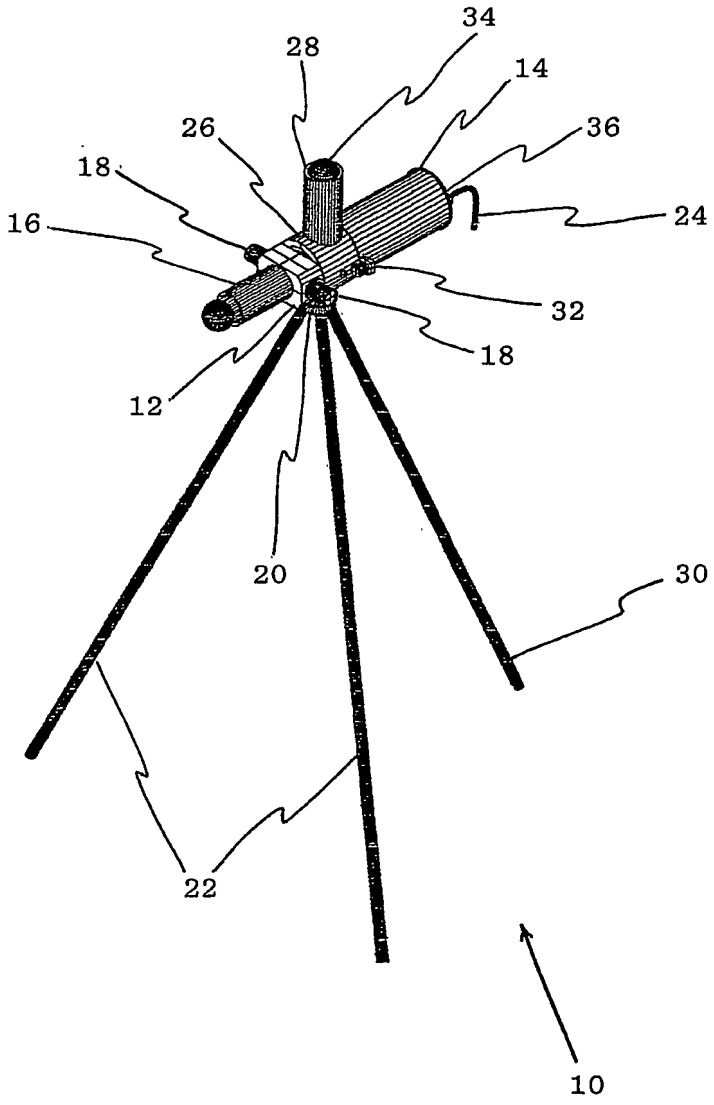

FIG 1

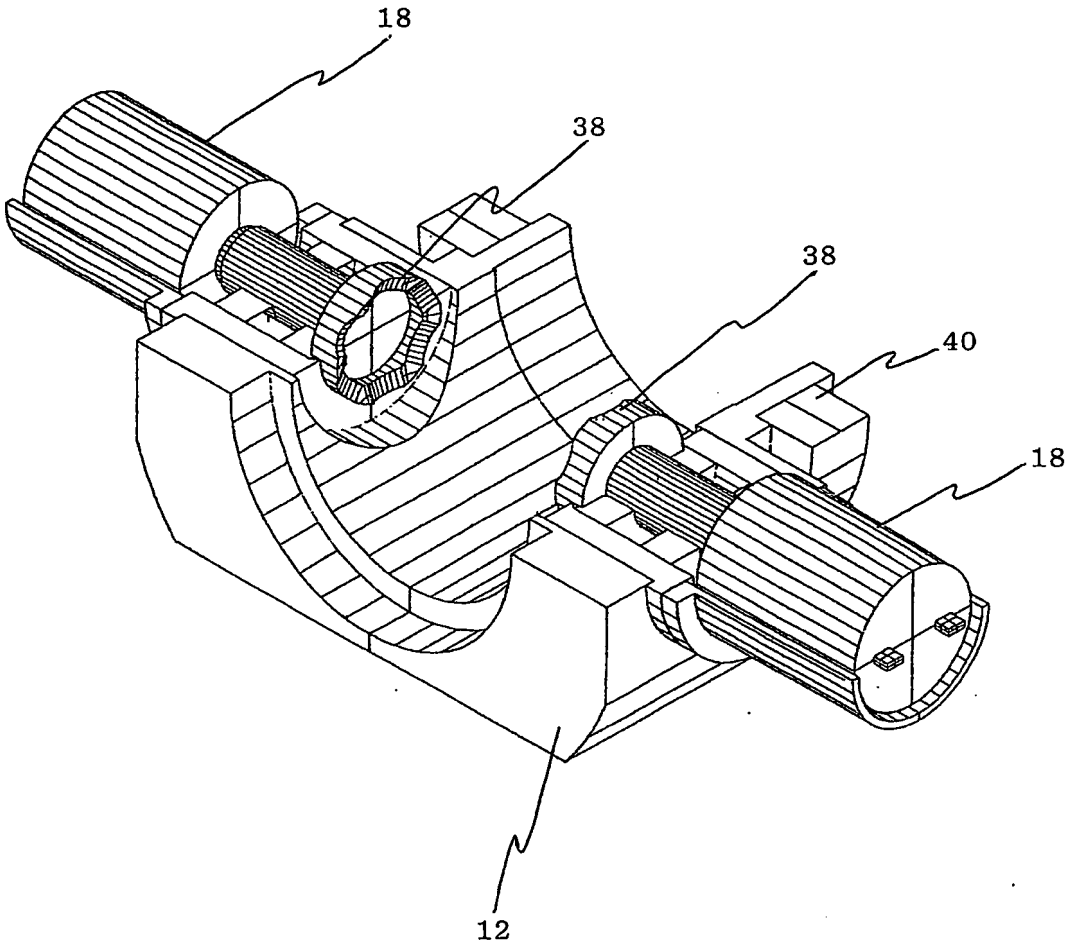

FIG 2

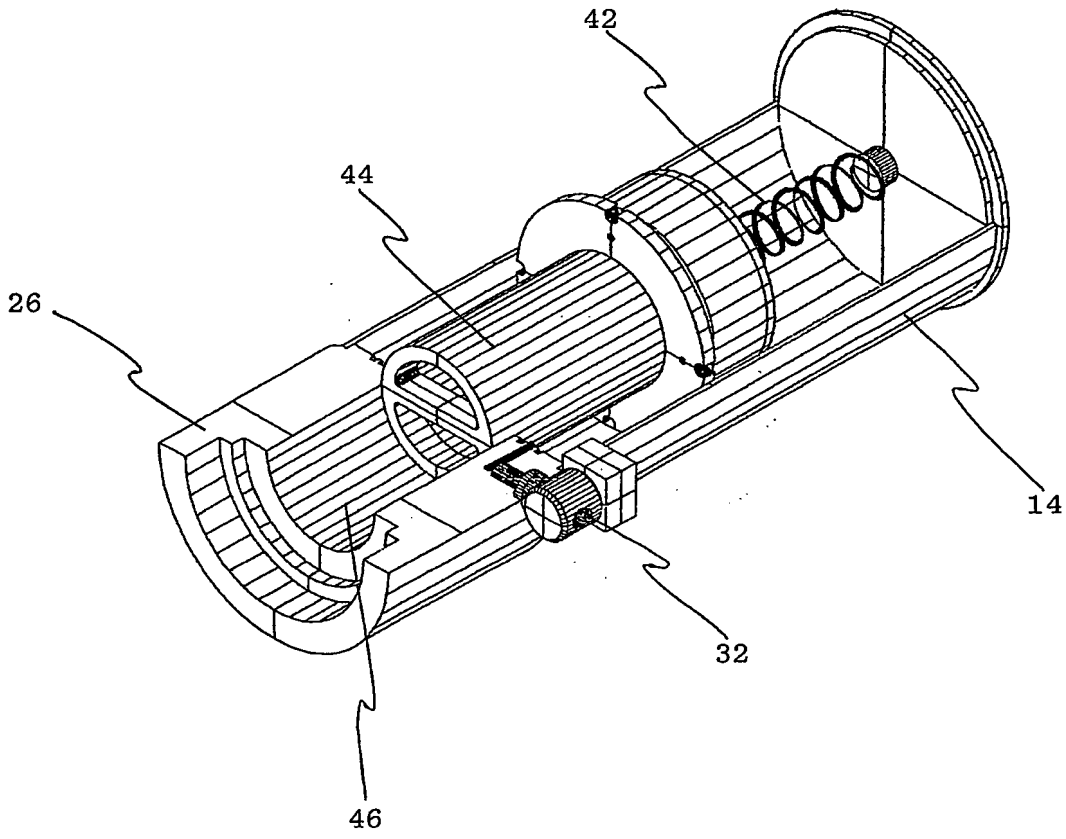

FIG 3

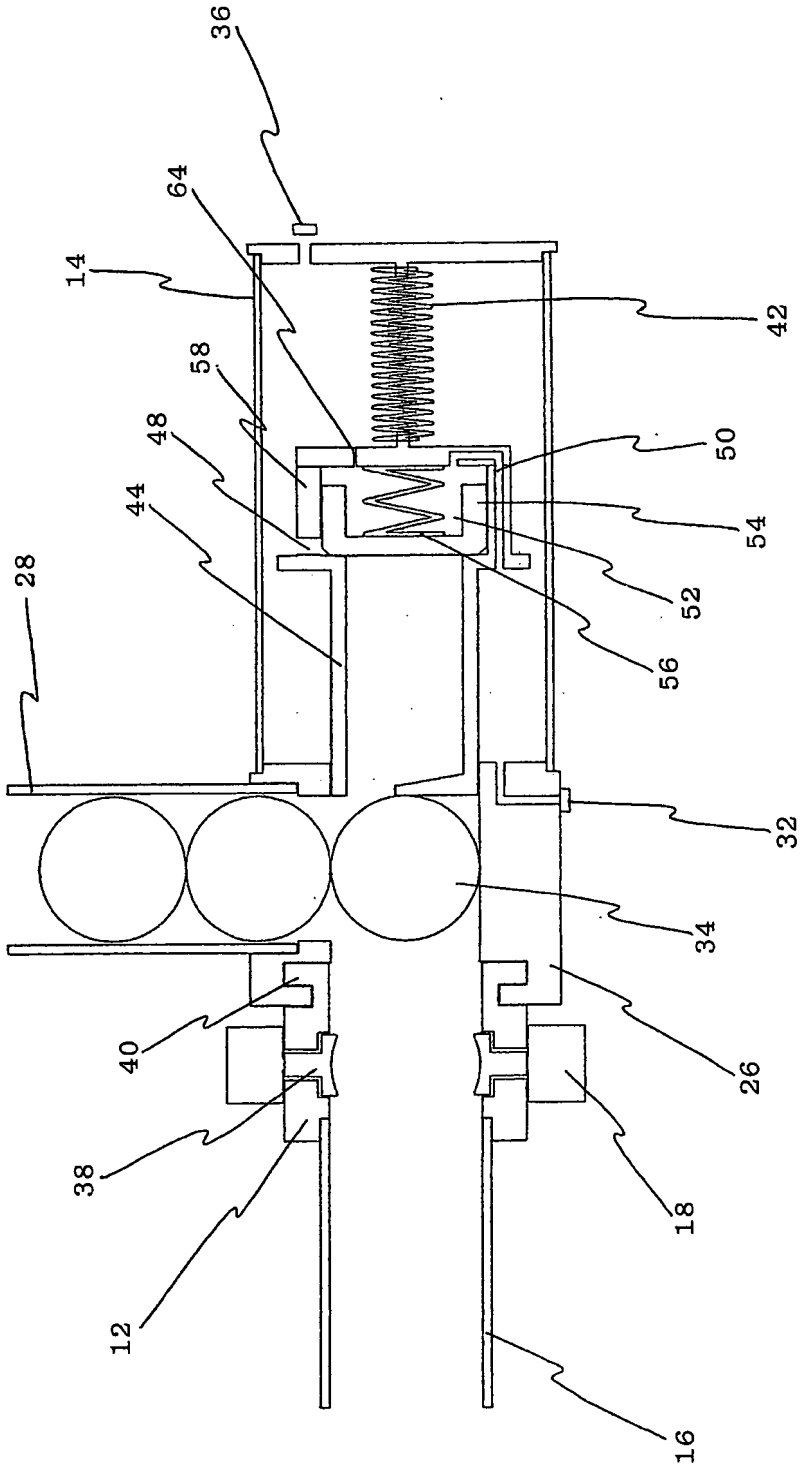

FIG 4(a)

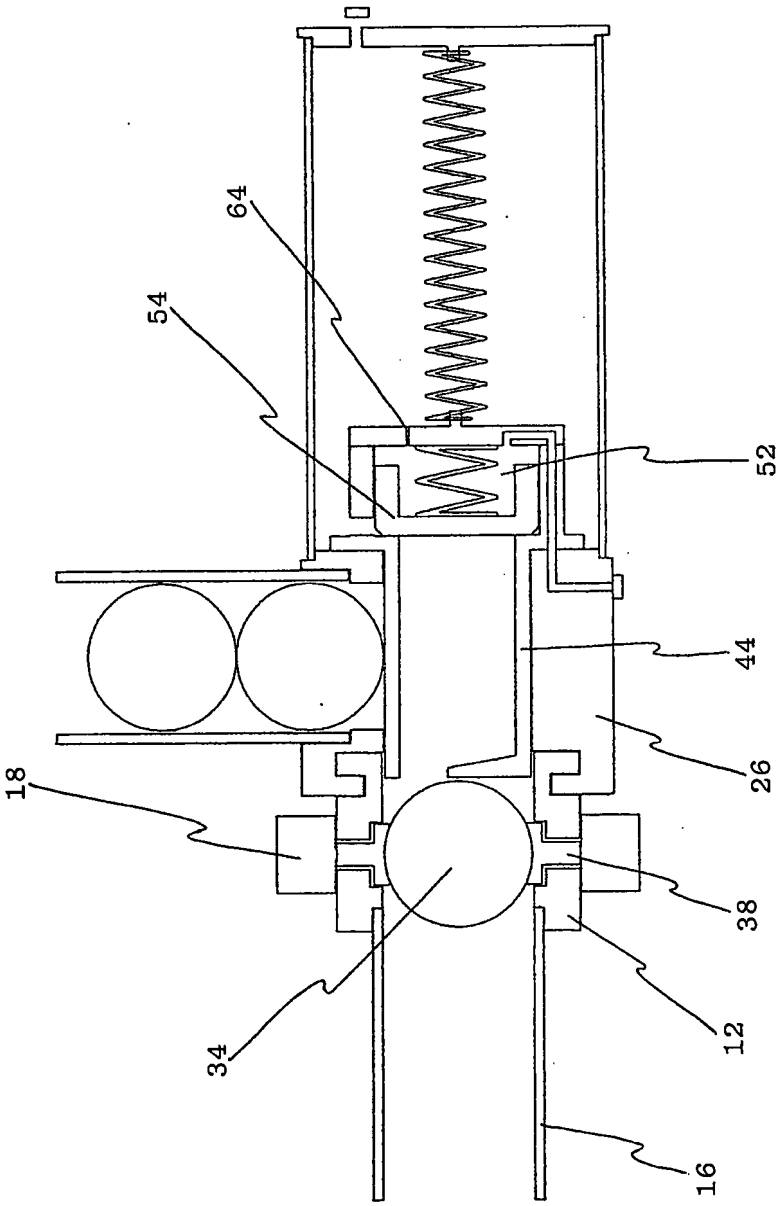

FIG 4(b)

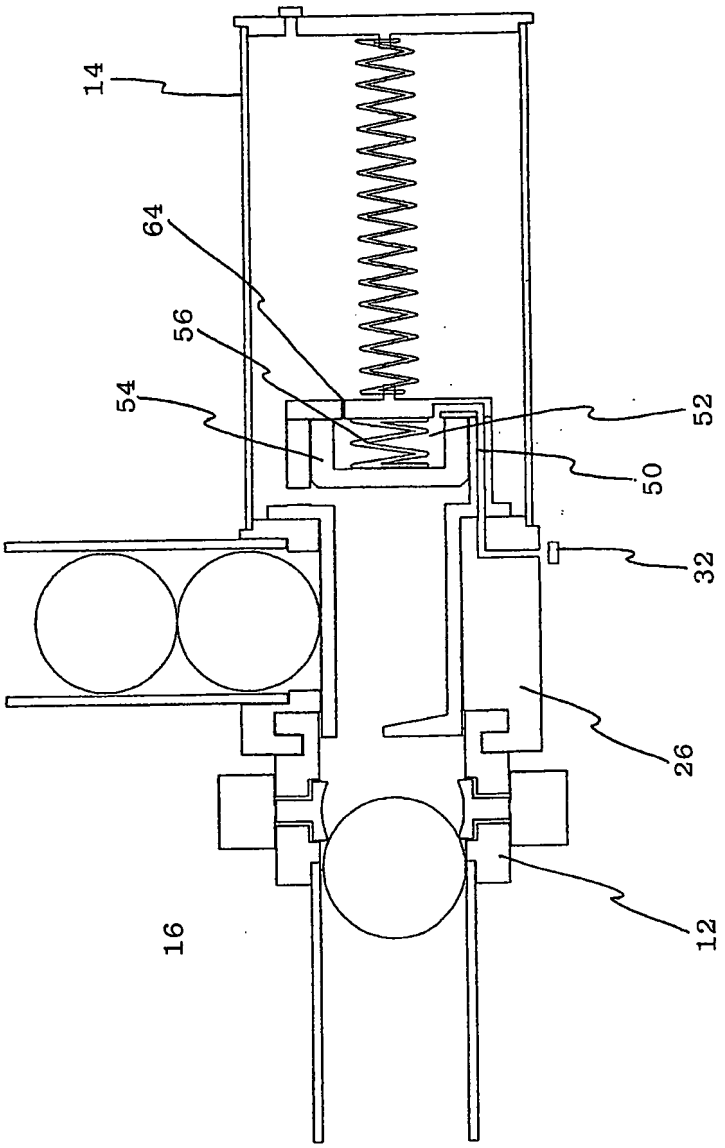

FIG 4(c)

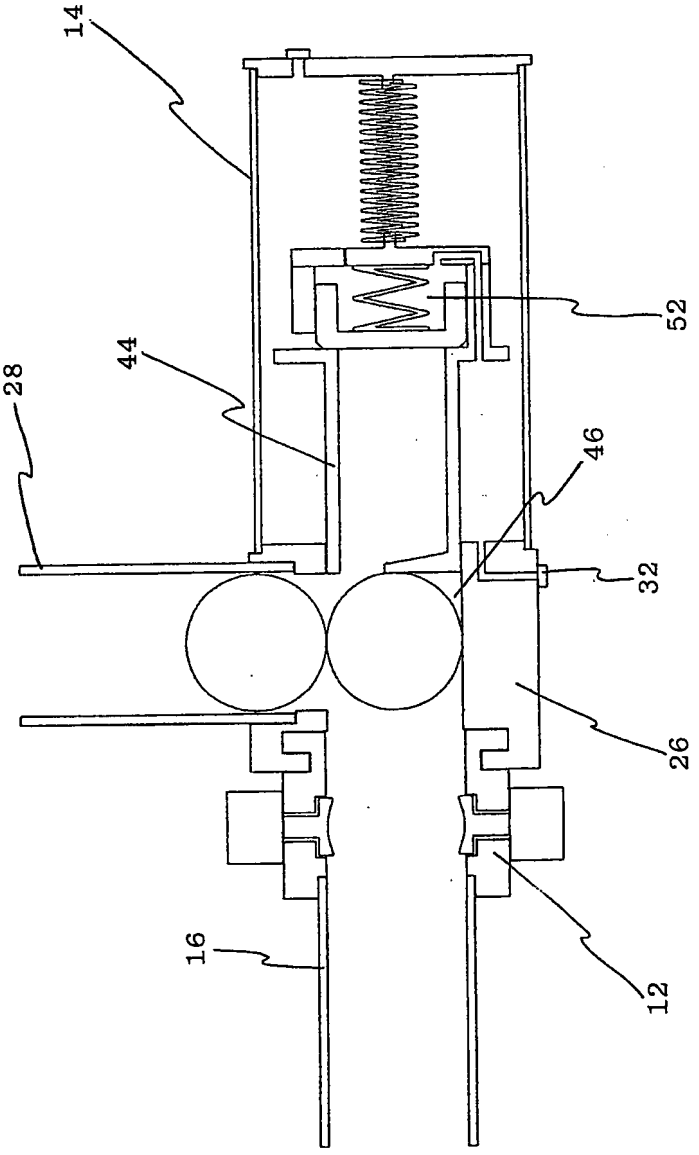

FIG 4(d)

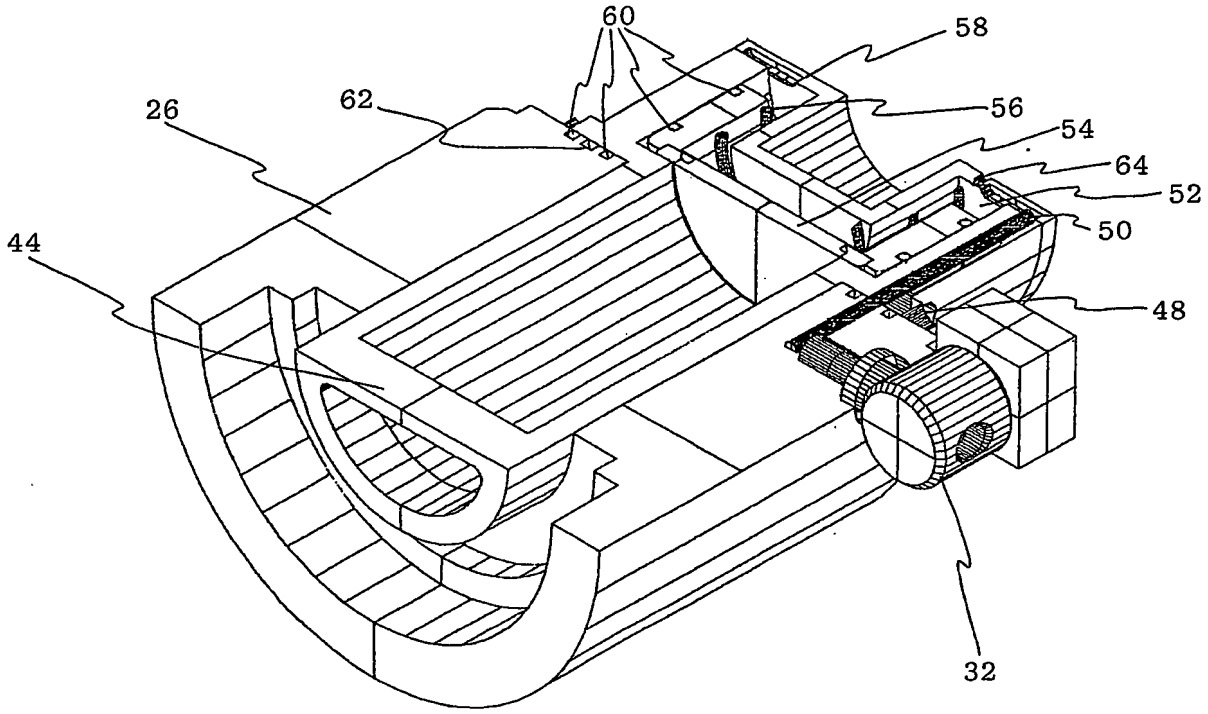

FIG 5

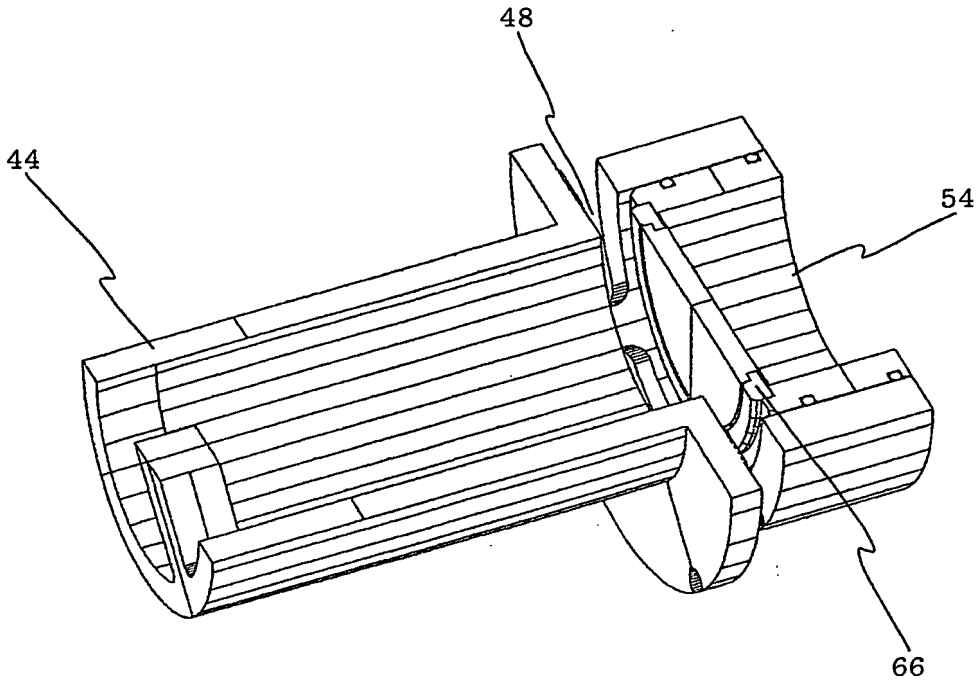

FIG 6

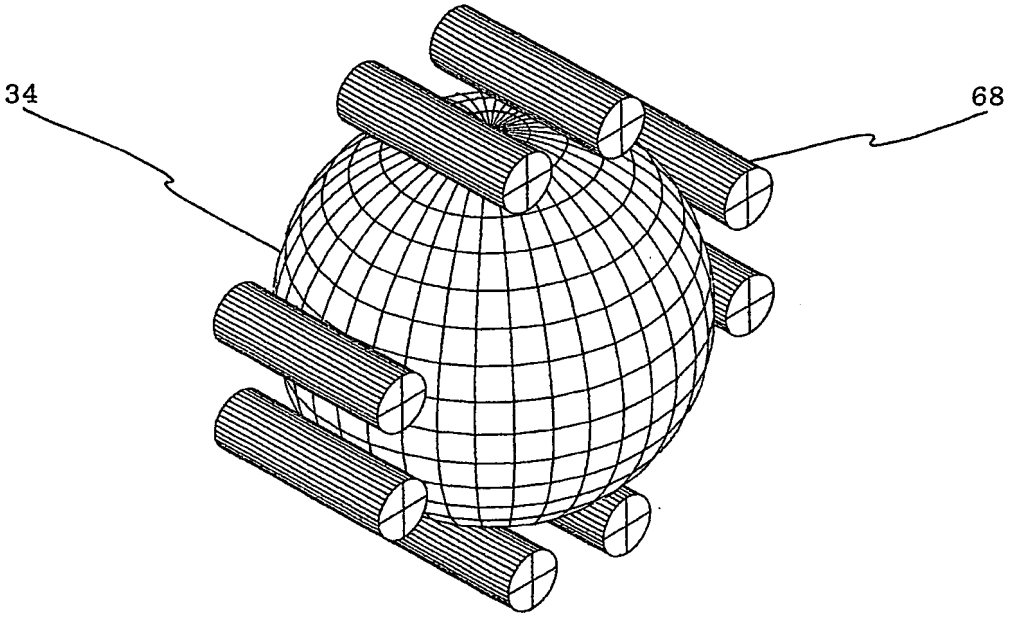

FIG 7

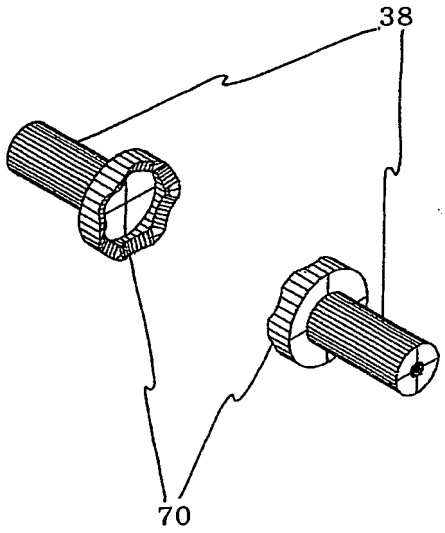

FIG 8

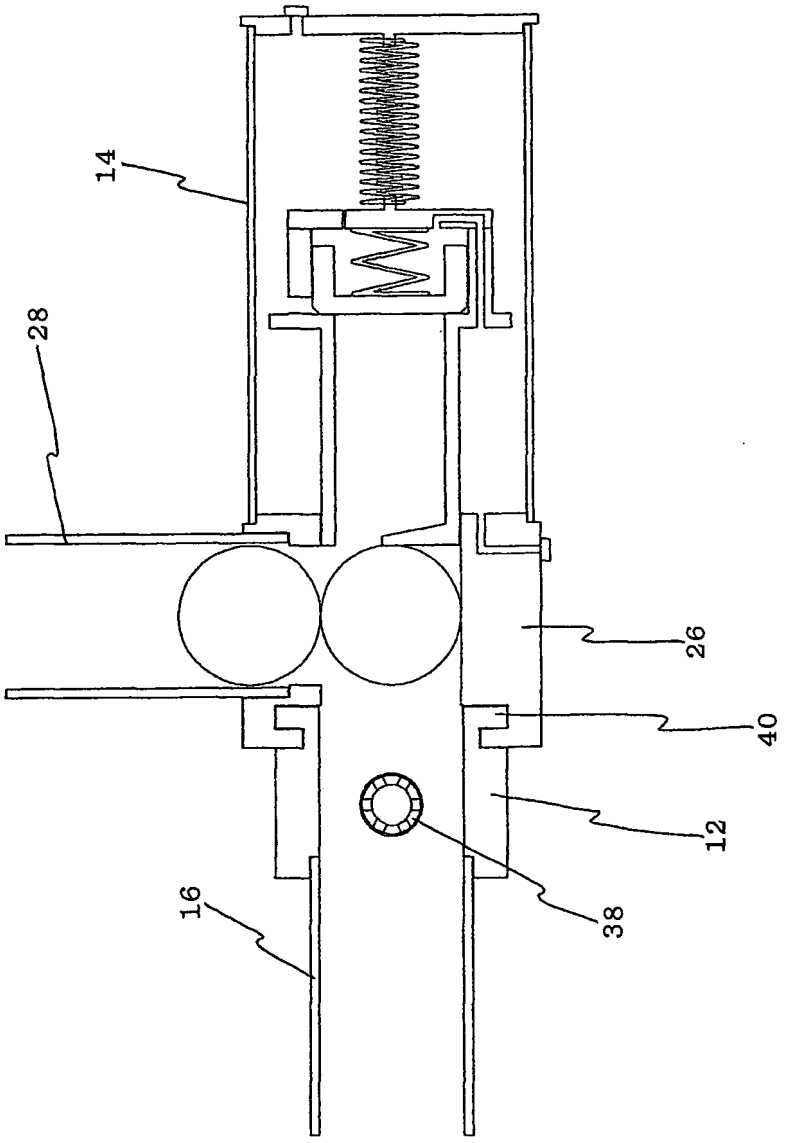

FIG 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU03/01188

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. [7]: A63B 69/40

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A63B, F41B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
DWPI +keywords: ball, projection, gas and similar terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 118 443 A (SUMSKY FILLIAL KHARKOVSKOGO POLITEKHNICHESKOGO INSTITUTA IMENI V I LENINA) 2 November 1983 Abstract and Figure 1	1, 3
X	US 4,091,791 A (CASTELLI et al) 30 May 1978 Abstract and Figure 3	1, 3
X	US 5,778,868 A (SHEPHERD) 14 July 1998 Abstract and Figures 1, 3 and 4	1, 3, 4, 5

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"B" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
1 December 2003	5 DEC 2003

Name and mailing address of the ISA/AU	Authorized officer
AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	SUE THOMAS Telephone No : (02) 6283 2454

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU03/01188

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,769,066 A (SCHNEIDER) 23 JUNE 1998 Abstract and Figures 22, 23 and 24	1, 3, 4, 5
A	US 4,523,573 A (DEFOSSE et al) 18 June 1985 Abstract	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU03/01188

Box I **Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos :

because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos :

because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos :

because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II **Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

Claims 1-13
Claims 14-16
Claim 17

See supplemental box

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-13

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU03/01188

Supplemental Box
(To be used when the space in any of Boxes I to VIII is not sufficient)

Continuation of Box No: II

The international application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept. In coming to this conclusion the International Searching Authority has found that there are different inventions as follows:

1. Claims 1-13 are directed to a machine for propelling a ball including the use of compressed gas to propel the ball. It is considered that the use of compressed gas to propel a ball comprises a first "special technical feature".

2. Claims 14-16 are directed to a method of aligning a ball with surface stitching between two opposed rotating ball supports by rotating the ball supports at different angular velocities. It is considered that a method of aligning a ball by rotating ball supports at different angular velocities comprises a second "special technical feature".

3. Claim 17 are directed to a machine for propelling a ball comprising a ball support capable of applying spin to a ball. It is considered that a ball support capable of applying spin to a ball comprises a third "special technical feature".

Since the abovementioned groups of claims do not share any of the technical features identified, a "technical relationship" between the inventions, as defined in PCT rule 13.2 does not exist. Accordingly the international application does not relate to one invention or to a single inventive concept, *a priori*.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU03/01188

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
GB	2118443	DE	3213727	FR	2524811		
US	4091791						
US	5778868						
US	5769066						
US	4523573	AR	224766	AR	226308	BR	8002747
		DD	150432	DK	163080	EP	0018444
		ES	8101394	JP	55155667	MX	150693
		SU	1082306				

END OF ANNEX